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that any other number should be out of order. I propose to solve the problem by assuming a looms, each netting m dollars a day when in order, x weavers, each getting n dollars a day, whether working or not, and p the probability of a single loom being out of order. We have then to take the general mean of the following cases:

No. of looms in order.	Profits.	Probability.	
a	mx	$(1-p)^a$	$= P_a$
$a-1$	mx	$\frac{a}{1}\left(1-p\right)^{a-1} p$	$= P_{a-1}$
$a-2$	mx	$\frac{a}{1}.\frac{a-1}{2}\left(1-p\right)^{a-2} p^2$	$= P_{a-2}$
.	.	. . . .	.
x	mx	$\frac{a}{1}.\frac{a-1}{2}\dots\frac{x+1}{a-x}\left(1-p\right)^{x} p^{a-x}$	$= P_x$
$x-1$	$mx-(m+n)$	$\frac{a}{1}.\frac{a-1}{2}\dots\frac{x}{a-x+1}\left(1-p\right)^{x-1} p^{a-x+1}$	$= P_{x-1}$
$x-2$	$mx-2(m+n)$	$\frac{a}{1}.\frac{a-1}{2}\dots\frac{x-1}{a-x+2}\left(1-p\right)^{x-2} p^{a-x+2}$	$= P_{x-2}$
.	.	. . . .	.
1	$mx-(x-1)(m+n)$	$\frac{a}{1}\left(1-p\right)p^{a-1}$	$= P_1$
0	$mx-x(m+n)$	p^a	$= P_0$

We have then the average profit

$$y_x = mx-(m+n)\Sigma_1^x[sP_{x-s}].$$

If this is a maximum then

$y_x - y_{x-1} = \Delta y_x = m-(m+n)\Sigma_1^x [P_{x-s}]$ is small and positive,

& $y_{x+1} - y_x = \Delta y_{x+1} = m-(m+n)\Sigma_1^{x+1} [P_{x+1-s}]$ is small and negative,

Placing $a = 60$, $m = 3$, $n = 1$ and $p = 0.1$ we find $\Delta y_{56} = +0.021$ and $\Delta y_{57} = -0.113$. Therefore $x = 56$ weavers.

ANSWERS TO QUERIES IN NUMBER FOUR.

"QUERY BY PROF. A. HALL.—(1). If v be the potential function we have the equation given by Laplace

$$\frac{d^2 v}{dx^2} + \frac{d^2 v}{dy^2} + \frac{d^2 v}{dz^2} = 0,$$

which holds for a point outside the attracting body. For a point inside this body we have the equation given by Poisson,

$$\frac{d^2 v}{dx^2} + \frac{d^2 v}{dy^2} + \frac{d^2 v}{d z^2} = -4\pi\rho.$$

What is the value of the right hand side of this equation for a point on the surface of the attracting body? Moigno says, "in this case the expression will have in reality eight distinct values." Statics, p. 460."

ANSWER BY ORMOND STONE, A. M., DIRECTOR OF CINCINNATI OBSERVATORY.

In order that the expression may have eight values at the surface of the attracting body it is necessary to assume that the differential coefficients

$$\frac{d^2v}{dx^2}, \quad \frac{d^2v}{dy^2}, \quad \frac{d^2v}{dz^2}$$

are independent of one another, an hypothesis which is inadmissable, since each is a function of the same variable

$$r = \sqrt{(\xi-x)^2 + (\eta-y)^2 + (\zeta-z)^2}.$$

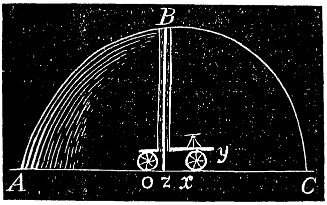
The expression has in general only two values, $-4\pi\rho$ and 0, according as the displacement of the point attracted is such as to cause it to enter the attracting mass or not. For if a line be drawn through the given point, then for two points in this line, one within, the other outside the mass, there will be two potentials v_1 and v_2, each of which will have a value whose limit will be v. The simplest illustration is the case of the sphere, in which we have for a point at the surface $r = R$, and

$$v_1 = 2\pi\rho(R^2 - \tfrac{1}{3}r^2) = v_2 = \tfrac{4}{3}\frac{\pi\rho R^3}{r} = v = \tfrac{4}{3}\pi\rho R^2.$$

(2) "Given a hemispherical dome turning about a pin at the top, and having a slit extending from the horizon to the zenith. Can a telescope be placed inside this dome in such a position that every point of the heavens can be seen through the telescope?"

ANSWER BY PROF. W. P. CASEY, SAN FRANCISCO, CAL.

A telescope may be placed inside the dome as required in various ways; thus, let ABC be a section of the dome, having BC the slit and Bz the axis on which the dome revolves and which supports it, and let this axis be encircled by a cylinder attached to the dome and also supported by the wheels o, x, having a small platform y, upon which a telescope may be placed which will revolve with the dome as required. Or a floor may be attached to the dome and be supported upon wheels.



QUERY BY T. W. WRIGHT, U. S. LAKE SURV., DETROIT, MICH.—"Can a satisfactory proof be given of the statement that "the weight of an observation varies as the square of the probability of its accuracy"? (Monthly Notices R. A. S., Vol. XIII.)"

ANSWER BY CHAS. H. KUMMELL, U. S. LAKE SURVEY.

The proof, at the place cited rests essentially on the incorrect expression for the probability of an error x, viz.,

$$\varphi(x) = \frac{h}{\sqrt{\pi}} e^{-h^2x^2},$$

which is so given in most treatises on the method of Least Squares (some modern authors excepted) since Gauss first gave it in "Theoria Motus" in this form. It is clear that such an expression is approximately proportional to h, the precision, and therefore to the square root of the weight. Hence the pretended proof. The correct expression for the probability of an error x (see for ex. ANALYST, Vol. III, p. 135 et seq.) is however:

$$\varphi(x) = \frac{hdx}{\sqrt{\pi}} e^{-h^2\pi^2},$$

and since as I have proved l. c., the factor

$$\frac{hdx}{\sqrt{\pi}} = \frac{dx}{\varepsilon\sqrt{2\pi}} = \varphi(0) = \frac{1}{\sqrt{(\Omega\pi)}}$$

is an absolutely constant infinitesimal, being the same for all classes of observations, the fallacy of this proof is at once apparent. The very elegant writer of the Monthly Notices, J. W. L. Glaisher, F. R. S., proposed this method of reweighting observations of the same quantity, of which, for a first approximation, the arithmetic mean has been taken. The propriety of such a process (first suggested by Prof. De Morgan), provided weights could be used which are derived from correct principles, I do not altogether question. At present I have several plans of reweighting, each of which has some reason in its favor. One consists in weighting the observations by their respective probabilities or what is the same, by the finite variable factor $e^{-\triangle^2 \div 2\varepsilon^2}$ ($d\triangle \div \varepsilon\sqrt{2\pi}$ being an absolutely constant infinitesimal, ANALYST, Vol. III, p. 135). These numbers, used as weights, are proport'al to the number of times each of the errors Δ_1, Δ_2, . . . Δ_m should have occurred if there had been an infinite number of observations of the same precision. If the observations have different weights p_1, p_2 . . . . p_m we compute the second weights p'_1, p'_2 . . . . . p'_m by the same formula, ε denoting mean error of an observation of weight 1. This process is theoretically to be repeated until the weights do not change any more and the mean value reaches a certain limit.—[No answer to Prof. Johnson's Query.]